

SHARING NETWORK RESOURCES

After reading this chapter and completing the exercises, you will be able to:

- ◆ Understand resource sharing and the steps necessary to share resources, files, folders, and printers on a Windows 2000 Server
- ◆ Discuss IntelliMirror and the software installation and maintenance features
- ◆ Install and configure Internet Information Services for sharing Web resources
- ◆ Install and configure Windows 2000 Terminal Server

Perhaps the single biggest reason for installing a network is to share resources such as files and printers. This chapter explores the areas of resource sharing. In addition, it discusses three advanced Windows 2000 features: IntelliMirror, Internet Information Server (IIS), and Terminal Server.

RESOURCE SHARING BASICS

An encounter with the topic of resource sharing poses an important initial question: What is a resource and how can it be shared? Quite simply, a resource on a Windows 2000 network is anything to which users would like access. It includes everything from disk space on the file server's hard drives to networked printers to modem pools. The principle of sharing resources inspired the development of the first networks, and it remains the foundation of Microsoft's networking model. In later sections of this chapter, we'll discuss file and printer sharing.

When a resource is connected directly to a computer on the network, the user of that computer has access to the resource. For example, before many networks were installed, each computer in a company had its own printer. If a particular user required multiple types of printers, the user had direct connections to those printers in the immediate area. As you can imagine, this approach could get rather expensive, particularly because everyone wanted laser printers sitting on their desks. In addition, if one user needed to access files that were located on another user's computer, the user had to transport the files via "sneakernet"—that is, put them on a floppy disk or tape and walk them to their destination.

With the advent of networks, this picture changed rather dramatically. Now, resources such as printers can be shared over the network to allow users who are not directly connected to the physical devices to use them. To accomplish this goal, the computer that manages the device need only be configured to allow remote users to access the resource. We'll get into the nitty gritty of how this operation is performed with particular resources in later sections of this chapter.

Finding Resources

When a resource is configured to be shared over the network, it makes this information known through a series of **broadcasts**. To find a resource on the network, the Windows-based client computers monitor the broadcasts. Windows 2000 computers keep a list of the available resources and display them when the **My Network Places** icon is accessed. Figure 11-1 shows the My Network Places dialog box for a Windows 2000 Server connected to a small network.

Although this dialog box serves a purpose similar to that of Network Neighborhood in Windows 95/98 and NT 4.0, Microsoft has expanded its functionality quite a bit. My Network Places is designed to be the location for shortcuts to your most-used shared network folders. You can create these shortcuts by using the Add Network Place applet, which is accessed by double-clicking the Add Network Place icon from within the My Network Places applet. When you select this option, you are prompted to provide the location of the **Network Place**, or you can utilize the Browse button to find the folder on the network. The LANWrights folder shown in Figure 11-1 is a shortcut to a folder on another computer on the network.

Also in the My Network Places dialog box are the Entire Network and Computers Near Me icons. Clicking the Entire Network icon displays all domains and workgroups on the network; you can browse through these items to find network resources.

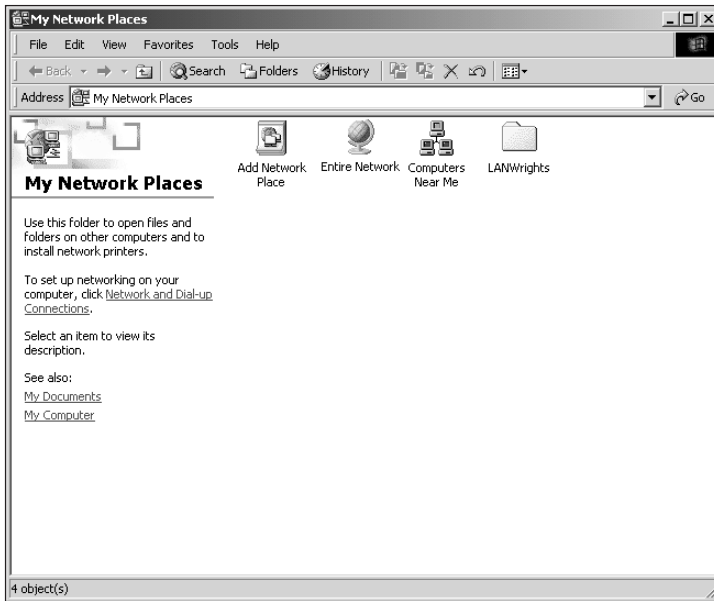


Figure 11-1 My Network Places dialog box on a Windows 2000 Server

Clicking the **Computers Near Me** icon displays the computers and other network resources that reside in the same domain or workgroup as the local computer. For example, if computers JOHNSYS1, AUSSERV, and MAMAPUTER are in the domain AUSTEX, and computers ANDERCOMP, DALSERV, and MARYSYS are in the domain MAINOFFICE, the **Computers Near Me** dialog box on JOHNSYS1 would include only JOHNSYS1, AUSSERV, and MAMAPUTER, as shown in Figure 11-2.

Because many clients that will be connecting to Windows 2000 Servers will not also run Windows 2000, it's important to note the similarities between Windows 2000 applications and applications in other Microsoft operating systems. As mentioned earlier, **Network Neighborhood** is the Windows 95/98 and NT 4.0 utility that is used to locate network resources. Like the **Computers Near Me** dialog box, **Network Neighborhood** lists computers in the same domain or workgroup. The **Entire Network** icon performs the same function in earlier versions of Windows as it does in Windows 2000—displaying all domains and workgroups on the network.



Unfortunately for those clients using earlier versions of Windows, no quick method exists for adding shortcuts like the **Add Network Place** icon.

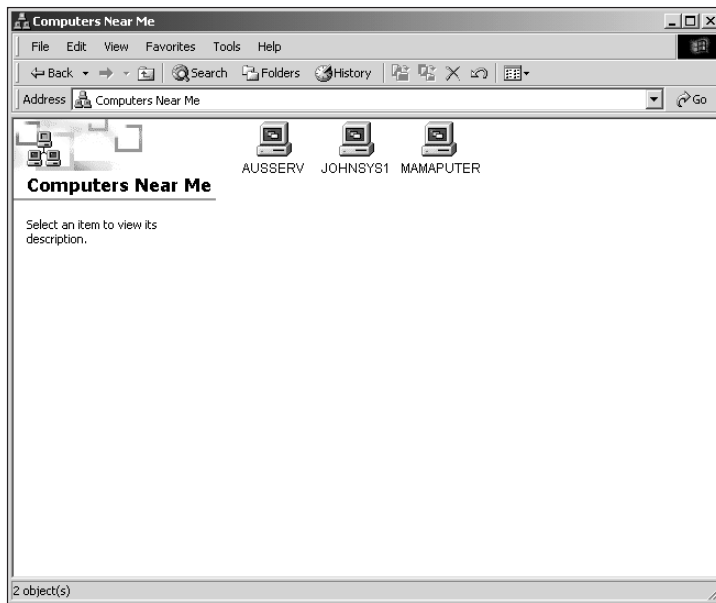


Figure 11-2 The members of the AUSTEX domain

Connecting to Resources from the Client

From a client computer on the network, connecting to shared resources is as easy as a double-click. Once the user finds a resource through the My Network Places dialog box, he or she can access it by double-clicking its icon. If the user that is logged into the client computer has been granted permission to use the resource, access will be given immediately. If the user is not on the list of users permitted access, however, an Access Denied dialog box will be displayed. You'll learn more about granting access permissions to users and groups in Chapter 12. For now, be aware that network resources can be secured from unauthorized access by using the Windows 2000 security features.

If a user is granted access to the resource, he or she can create a shortcut to the resource or use the Map Network Drive feature in Windows Explorer to create a permanent path to the object. Mapping a network drive assigns a drive letter to the remote resource so that the local operating system sees the remote drive as if it were directly attached. For example, most computer systems include multiple drives. A user may choose to connect to the network and map a drive to the location of the e-mail program used by the company. He or she might decide to use the M: drive to indicate the mail directory (although users may choose any drive letter that is not already in use). In this example, the user's Windows Explorer window will contain four drive letters, A:, C:, D:, and M:. This mapping decreases the complexity of repeatedly finding frequently used network resources and ensures that the user is always able to find the e-mail program. Many companies use this method for locating departmental folders on the network's servers as well as applications such as e-mail.

DEVICE SHARING

As mentioned earlier, for devices to be accessed by other computers on the network, they must be shared on a local computer. This statement holds true for both Windows 2000 Server and Windows 2000 Professional systems, as well as for Windows 95, 98, or NT. Like accessing shared resources, the act of sharing the device is fairly straightforward. The various permissions available for each device can, however, make it a challenge.

Using Windows Explorer and My Network Places

The first step in sharing a device is performed through Windows Explorer or My Network Places. By default, no devices are shared in Windows 2000. Each device to be accessed by remote users must be shared manually. Figure 11-3 shows the My Computer window on a basic Windows 2000 Advanced Server computer. To share the CD-ROM on this computer, you would right-click the SBE97CD2 (E:) icon and select Sharing . . . from the menu that appears. Note that you would reach the same configuration window by selecting Properties from the File menu and selecting the Sharing tab. After you make a selection, the Properties dialog box appears.

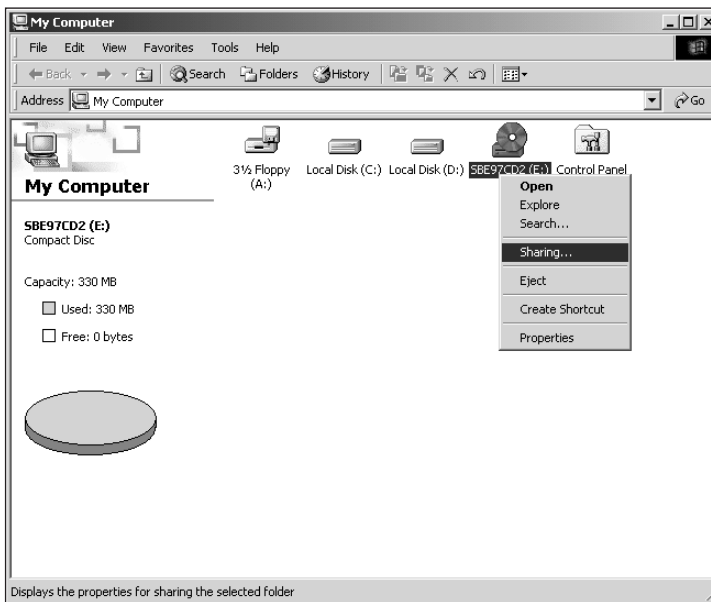


Figure 11-3 Sharing the CD-ROM on a Windows 2000 Advanced Server computer

As shown in Figure 11-4, the Do not share this folder option is selected by default. To share the device, select the Share this folder radio button. The Sharing tab of this dialog box is the same regardless of the resource being shared.

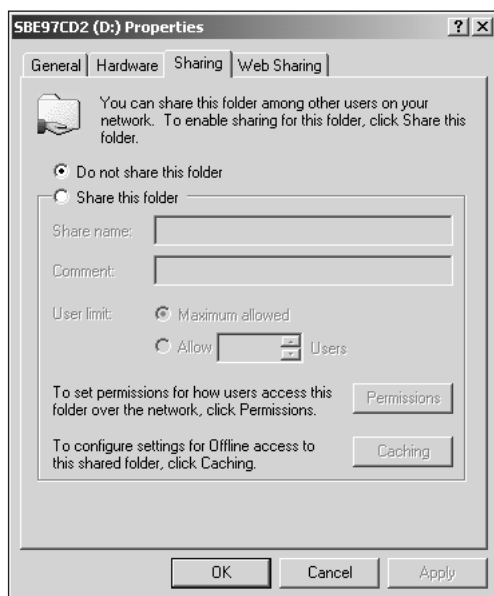


Figure 11-4 Properties dialog box for the CD-ROM device

After selecting **Share this folder**, you are presented with options for naming the share (share name), a comment, and the number of users who will be allowed to access the resource simultaneously. By default, the share name is the same as the device name. In the case of the CD-ROM device on the Windows 2000 Server, it is E. It is usually a good idea to change the share name to something that is easily understood by all users on the network. Imagine a network with 300 servers, all of whose E: drives were shared with the device name E. Such a network would be completely unusable. In this case, our server's name is AUSSERV, so we will call our share AUSSERV CDROM.

Comments that are added during the sharing process are displayed on client computers in Windows Explorer when the device is accessed if Windows Explorer is set to the Detail view. For the purpose of this example, we'll include the comment "CD Drive on the Austin Server." Figure 11-5 shows how this information is displayed through Windows Explorer on a client computer.

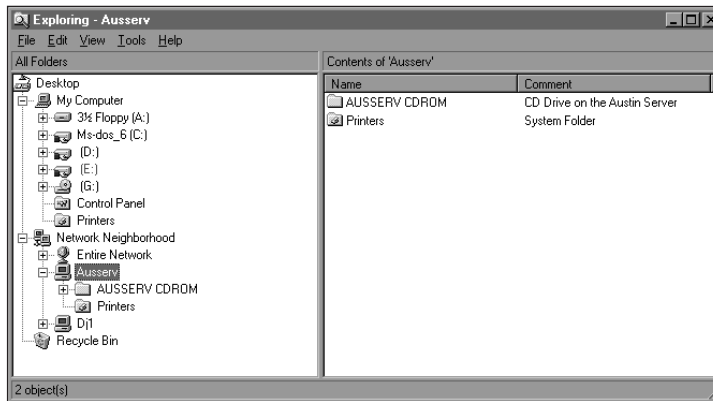


Figure 11-5 Share comments displayed on a client computer

Also on the Sharing tab of the Properties dialog box are settings for the number of users who can simultaneously be connected to the shared device, a Permissions button, a Caching button, and a New Share button. If more than one share exists for a particular device, a Remove Share button is available.

By default, the Maximum allowed radio button is selected when a share is created. It allows all users who are logged into the system to access the share. The maximum number allowed is determined by the version of Windows 2000 that is running and the operating system license. For example, Windows 2000 Professional allows only 10 active remote connections. Therefore, only 10 users could possibly access a share on a Windows 2000 Professional system at any one time. In contrast, Windows 2000 Advanced Server does not limit the number of remote connections in the same way; selecting the Maximum allowed button means that many users might be accessing the share at the same time. This point is often not an issue with hard disk devices, but may become a performance issue when accessing devices such as CD-ROM drives. For this reason, you can also establish a set number of simultaneous connections by selecting the radio button next to Allow and specifying the number of users in the coinciding list box. In Figure 11-6, we have limited the number of users accessing the CD-ROM to 7.

Clicking the Permissions button opens the Permissions dialog box for the share. Permissions are described in greater detail in Chapter 12, but we will discuss the basics now. The dialog box is divided into two sections: the Name window and the Permissions window. The Name window lists the users, computers, and groups that have been granted permission to access the share. Clicking the Add button allows you to add new users, computers, or groups to the permissions list. As you might expect, clicking the Remove button deletes the selected object from the permissions list.

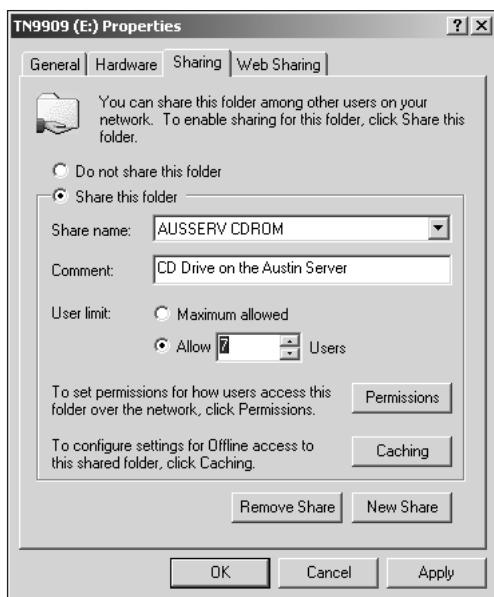


Figure 11-6 Limiting the number of users who can connect to a shared device

The Permissions window of the dialog box displays the access rights that the user, computer, or group is granted to the shared resource. As you work with Windows 2000, you'll run into this dialog box often. The same dialog box applies when sharing drives, folders, or files. For example, as shown in Figure 11-7, users can be granted or denied three types of access to a CD-ROM drive: Full Control, Change, and Read. The permissions shown in Figure 11-7 are granted by default when a share is created. The group Everyone is granted all access rights to the share. To restrict access to the resource, you can either uncheck the Allow box for the specific permission, or check the Deny box for the permission.



Because the default permissions for all new shares grant Full Control to the Everyone group, be sure to review these permissions anytime you create a new share to avoid any possible security breaches for sensitive information.

The Caching dialog box, which is accessed by clicking the Caching button on the Properties dialog box, is used to specify whether shared files can be accessed offline. When this option is enabled, the **Offline Files and Folders** feature allows mobile Windows 2000 users to access shared files and folders even when they are not connected to the network. To facilitate this access, Offline Files and Folders stores a copy of the files in the cache on the mobile computer. By default, the cache size is set to 10 percent of the available drive space and stored in the root directory of the hard disk.

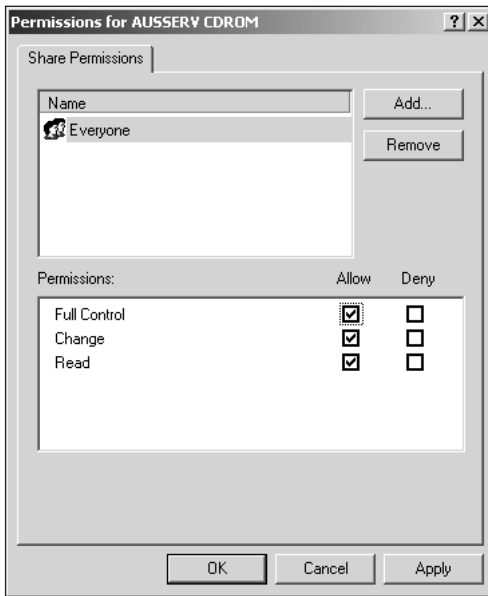


Figure 11-7 Permissions dialog box for the AUSSERV CDROM device

When sharing a resource, you have three options for caching files for offline access: **Manual Caching for Documents**, **Automatic Caching for Programs**, and **Automatic Caching for Documents**. By default, all shared resources are set to Manual Caching for Documents. With this setting, the user who seeks to access the shared files must manually configure them for offline access. Microsoft recommends this setting for shared folders containing files that can be accessed by several people.

The Automatic Caching for Programs option is the best configuration for folders containing files that do not change. When a user accesses the shared folder, Offline Files and Folders automatically copies the contents of the folder to the local cache. This option can be used to reduce network traffic, because the files are accessed from the cache rather than across the network. In turn, this strategy increases the speed with which the applications can be used. It is important when using this option to restrict the files in the shared folder to read-only access.

The last option, Automatic Caching for Documents, automatically loads the files that a user accesses into his or her local cache. Unlike with Automatic Caching for Programs, only those files that are opened by the user are copied to the cache; all files are not accessible offline.

FILE AND FOLDER SHARING

The principles behind sharing are the same regardless of whether a device, file, or folder is being shared. As you learned in Chapter 6, Windows 2000 supports two file systems: FAT32 and NTFS. The file system being used has an effect on your ability to share files and folders. The FAT32 file system does not include the detailed security information provided by

NTFS. For this reason, disks formatted as FAT32 can be shared only down to the folder level. If a FAT32 folder is shared, all files within the folder are accessible to remote users. NTFS partitions allow you to limit the access that users have to files in a folder, providing a higher level of security.

The process used for sharing folders, either on FAT32 or NTFS partitions, is basically the same as that used for sharing devices. Through Windows Explorer or My Computer, locate the folder to be shared. Right-click the folder name, and select Sharing from the menu. The folder's Properties dialog box, Sharing tab, will be displayed. The available options (Share Name, Comment, User Limit, Permissions, and Caching) are identical and perform the same functions.

Distributed File System

A new feature with Windows 2000 is the Distributed File System (DFS). DFS allows administrators to present a logical view of shares on multiple servers across the network. For example, before the advent of DFS, users had to know the Universal Naming Convention (UNC) path to each shared folder to which they needed access.

As networks grew and more servers were added, it became increasingly difficult for users to find the files and folders needed to perform their jobs. Using DFS, however, administrators can create logical views of the servers to facilitate browsing and file location. For example, an administrator can set up a DFS volume called **MARKETING** that includes shared folders on six servers on the network. From the user's point of view, all files are located on the **MARKETING** volume.

Managing DFS

DFS is managed through the Distributed File System tool, located in the Programs, Administrative Tools entry in the Start menu. A **DFS root** is the local server share that acts as the starting point for users to access the resources in the DFS share. To initiate a DFS root, select New DFS Root from the Action menu in the Distributed File System application, as shown in Figure 11-8. This selection initiates the New DFS Root Wizard, which steps you through the creation of a DFS root.

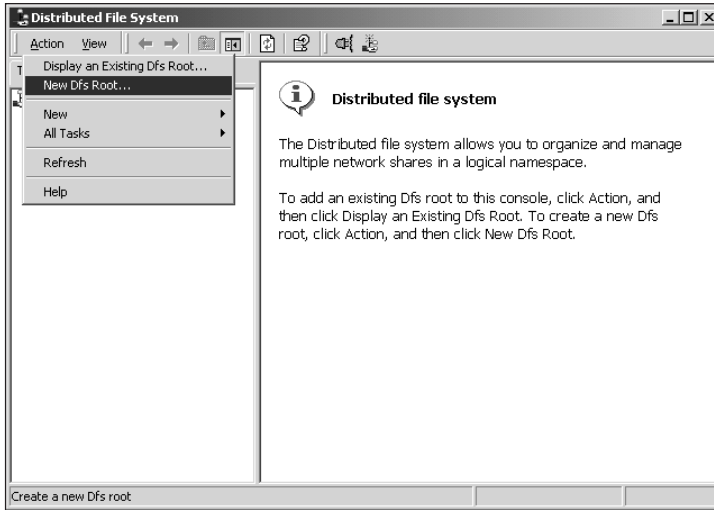


Figure 11-8 Creating a new DFS root

Creating a DFS Root

The first option with which you are presented when creating a new DFS root is whether to create a domain DFS root or a stand-alone DFS root. Domain DFS roots use Active Directory to store the DFS configuration and support DNS naming and automatic replication. Stand-alone DFS roots do not utilize Active Directory. After selecting the type of DFS root desired, you will be asked which server will host the DFS root. Most likely, it will be the server on which you are currently creating the root. If it is not, select the desired server by using the Browse button. Once the server has been located, click Next. You will then be asked to supply the name of the share that will act as the DFS root. As shown in Figure 11-9, you can use an existing share or create a new share in a specified location. After clicking Next, you can add comments to the DFS share. The final step is to confirm the configuration and click Finish in the New DFS Root Wizard.

Once the DFS root has been created, you can create **DFS links** to additional shares by choosing the New DFS Link option from the Actions menu. The Create New DFS Link dialog box enables you to name the link, locate the shared folder that is the basis of the link, and provide comments. Figure 11-10 shows the new LANW DFS root with additional links added on various computers on the network. On network client computers, all folders within the DFS root appear as if they were folders of the original share.

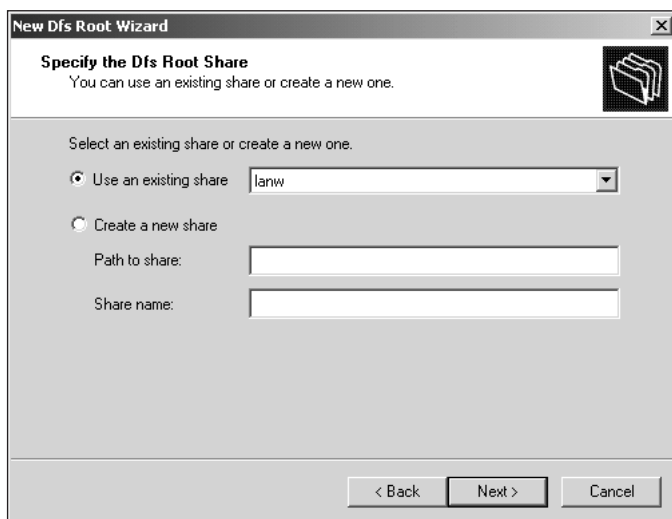


Figure 11-9 Selecting the new DFS root share

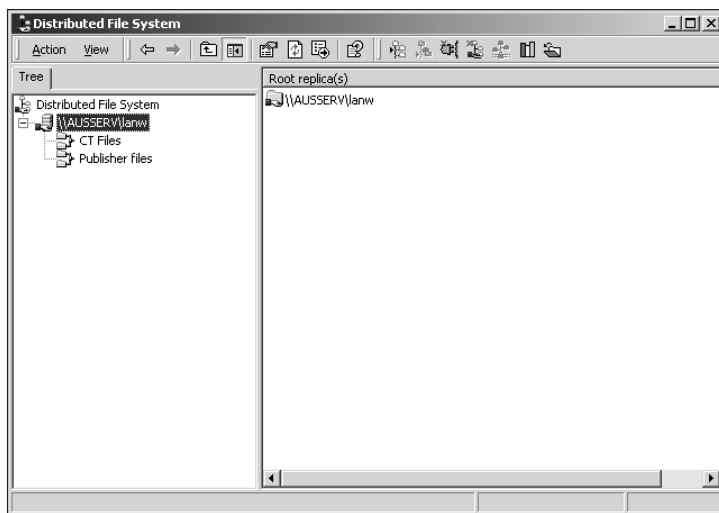


Figure 11-10 The LANW DFS root

PRINTER SHARING

The Windows 2000 environment allows you to share printing resources across an entire network and administer printing functions from a single location. The Windows printing system provides easy access for all Windows-based clients and can also be configured to support other client types, such as NetWare and Macintosh.

Like many things in the Microsoft environment, printing is handled in a special manner. More specifically, the terminology used in Microsoft printing may not always be what you expect. For example, most people think of a printer as a physical device that sits on the end of your desk and periodically produces printed output. In the Windows printing environment, it is called a **print device**, whereas a **printer** is actually a software interface between the operating system and the physical device. The printer configuration specifies where the document will be sent to reach the print device (that is, through a local port or across the network) and other variables such as when the job will be printed and how it will be handled by the operating system.

Two types of print devices exist in the Windows 2000 environment: the **local print device** and the **network-interface print device**. A local print device is directly connected to a port on the computer, such as the LPT port. This configuration is the one with which most people are familiar. As network computing has evolved, however, many companies have developed printing interfaces that allow printers to be directly connected to the network cabling, without the interference of a computer. An example of this type of device is the Hewlett-Packard JetDirect, which acts as a network interface for the printers to which it is attached. It provides for more efficient network configuration and speedier printing. A print device attached to this type of device is called a network-interface print device.

A **print server** is a computer that is configured to manage the printing activities of one or more print devices. Print servers receive print jobs from clients on the network and store them until the print devices are able to complete the jobs. Network printers are shared on print servers.

A **print driver** is a software component that is used to translate jobs into the language used by a printer, such as PCL or PostScript. Drivers are written for specific printers and usually cannot be interchanged. For example, the printer driver for a Hewlett-Packard LaserJet 6L cannot be used to send print jobs to an Epson Stylus 760C. It is important, then, that the appropriate drivers be loaded on the print server to ensure that documents print correctly.

Printing in Windows 2000

To print in a Windows 2000 environment, at least one computer must act as the print server. In most cases, you will want to use a Windows 2000 Server computer as the print server. For purposes of our examples here, we'll use a Windows 2000 Advanced Server computer with a Hewlett-Packard LaserJet 6L directly attached to the LPT port as the print server.



Before beginning the installation process, be sure that you are logged in as the Administrator.

Creating a Printer

On the server, start the Printers applet by selecting Start, Settings, Printers, or double-click the Printers icon in the Control Panel. The Printers dialog box will open. The first icon available in the dialog box is the Add Printer icon. Double-click Add Printer to start the Add Printer Wizard. After the wizard has started, click Next. The next dialog box asks you to select

whether the printer will be a local or network printer. Because our printer is directly attached to the computer, we'll select Local printer, as shown in Figure 11-11. For a local printer, Windows 2000 can detect and install the necessary drivers for Plug and Play devices. For this exercise, however, we'll uncheck this box and select the printer manually. Click Next.

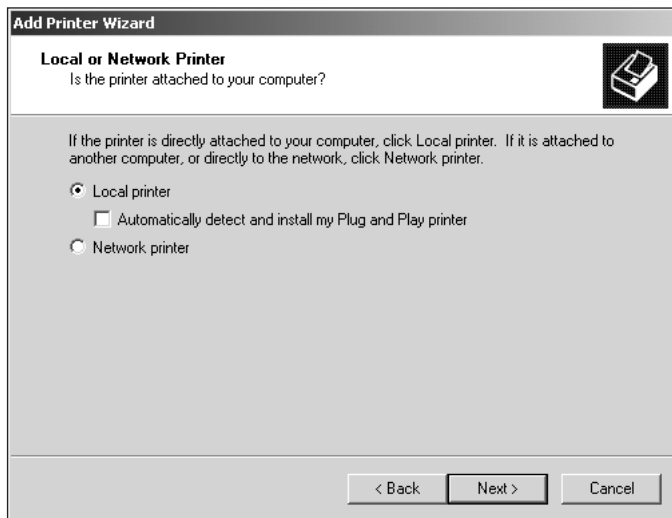


Figure 11-11 Selecting Local or Network printer

Next, select the port to which the printer is attached. In this case, the printer is attached to LPT1. An option in this dialog box also allows you to create a new port to which you can connect the printer. In most cases, you will not need to utilize this function for directly attached printers, but it may be necessary when connecting to a TCP/IP-enabled network-interface print device. To bring up the list of available printers for which Windows 2000 has included drivers, select LPT1 from the list of available ports and click Next. Drivers for many of the printers currently on the market are included with Windows 2000, including the Hewlett-Packard model we are using. If you are installing a printer that is not listed, click the Have Disk button and enter the path for the printer drivers. For our purposes, we'll select HP (for Hewlett-Packard) from the left side of the dialog box and HP LaserJet 6L, as shown in Figure 11-12. Click Next to continue.

Now you are prompted to provide a name for your printer. As when you are naming shares, the name for the printer should be unique and readily identify the printer and its location. If this device is not the first printer attached to the computer, the dialog box asks whether it should specify the new printer as the default printer for all Windows-based programs. Name the new printer Austin HP 6, and click Next to continue.

The next dialog box asks whether you want to share this printer on the network. In most cases, you will select "Share as" and provide a name for the share printer. We will cover sharing existing printers in the next section, so we'll select "Do not share this printer" here. Click Next to continue.

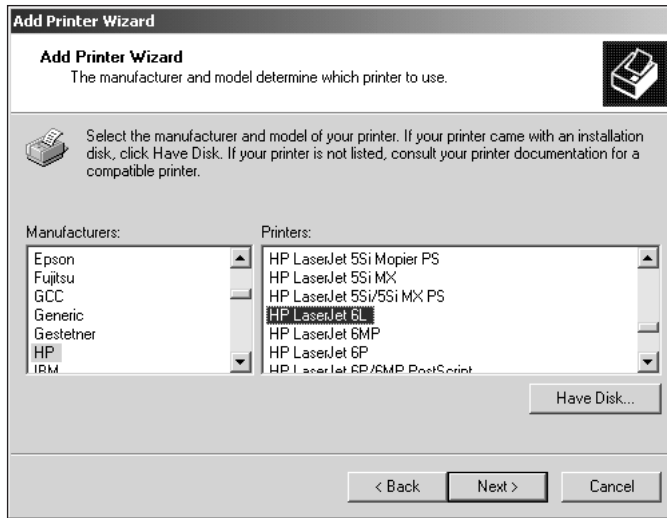


Figure 11-12 Selecting the printer driver

Finally, you are asked to print a test page. This test is always a good idea to ensure that the printer is connected and functioning properly. Select Yes and click Next to proceed to the end of the Add Printer Wizard. Clicking Finish, as shown in Figure 11-13, will print the test page and complete the installation of the new printer. After clicking Finish, the system will copy the necessary files from the Windows 2000 CD and print the test page as selected. Once the installation is complete, a dialog box will ask whether the test page printed correctly. Click OK if the page printed; otherwise, click Troubleshoot to utilize the Windows 2000 Help features to determine the cause of the error.

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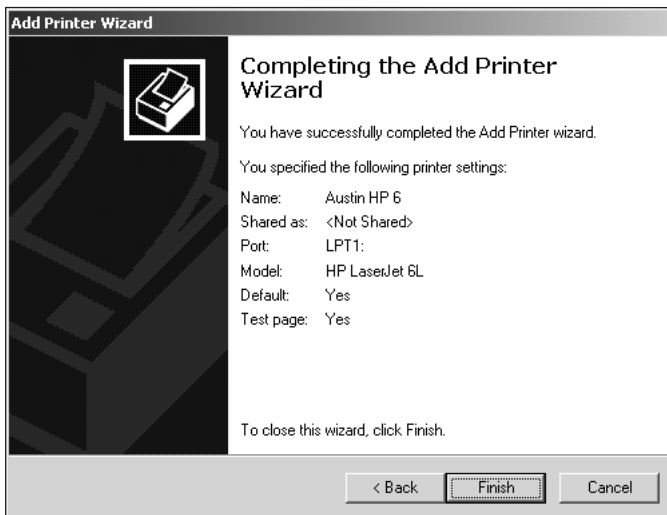


Figure 11-13 Finishing the new printer installation

Sharing Existing Windows 2000 Printers

As mentioned in the previous section, the process for adding a new printer on a Windows 2000 Server computer includes a step in which you can share the printer as it is created. On some occasions, however, printers that were not previously shared *must* be configured to be shared. As with other shared devices, this reconfiguration is a straightforward process. To begin sharing an existing print device, open the Printers dialog box through Start, Settings, Printers. Select the printer, and right-click its icon. Select Sharing from the displayed menu to open the printer's Properties dialog box, as shown in Figure 11-14. To share the printer, simply select the radio button next to Shared as: and provide a share name for the printer.

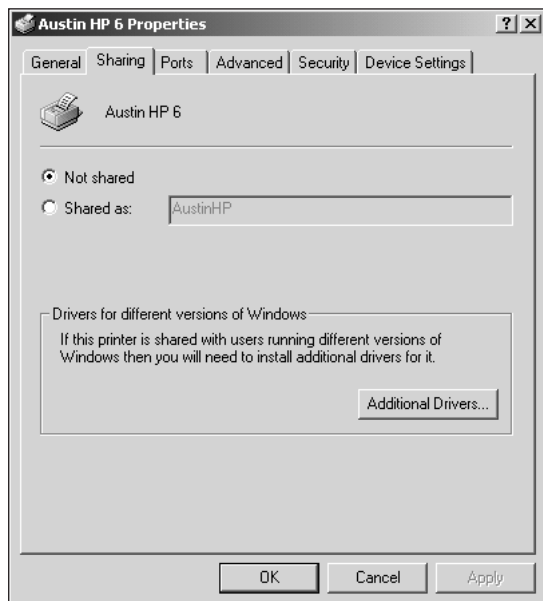


Figure 11-14 Properties dialog box for the Austin HP 6 printer



Unlike when sharing other devices, an Additional Drivers button appears on the printer's Properties dialog box, Sharing tab. This feature allows you to load the drivers for different Windows operating systems on the server so that any Windows client can print to the printer. The operating systems accommodated include Windows 95/98, Windows NT 3.51 and 4.0 on the Alpha computer, Intel, MIPS, and PowerPC platforms.

The various resources on Windows 2000 computers are shared in much the same way. In the next section, we'll explore sharing applications in a distributed manner by using the Windows 2000 new IntelliMirror features.

INTELLIMIRROR FOR APPLICATION DISTRIBUTION

With Windows 2000, Microsoft has introduced IntelliMirror, which is actually a combination of utilities that provide advanced control over computers on the network. IntelliMirror actually comprises three features: User Data Management, Software Installation and Maintenance, and User Settings Management. In this chapter, we'll look at the Software Installation and Maintenance feature of IntelliMirror.



For more information on the other IntelliMirror features, refer to the Windows 2000 Resource Kit or Microsoft TechNet.

The Windows 2000 Software Installation and Maintenance feature allows for policy-based deployment and software management. As upgrades become available, software can be configured to be automatically updated based on the policies in use on the Windows 2000 systems. The Software Installation and Maintenance feature uses just-in-time software installation and automatic repair of applications to provide seamless access to software, regardless of which computer the user utilizes to connect to the network. Once a user's profile has been created, the same applications and configuration will automatically follow the user to any computer on the network. The policies that govern the Software Installation service are defined on the basis of sites, domains, and organizational units in the Active Directory environment. (Active Directory was covered in detail in Chapter 10.)

Applications that use the Windows Installer service must be written to take advantage of its features. A prime example of this type of application is Windows 2000 itself. It can be configured to use the Windows Installer to remotely install and maintain the Windows 2000 operating system on computers on the network.

Administrators can use the Installer service to either publish or assign software to groups of users and computers. **Published software** is made available to users on an as-needed basis. That is, Administrators specify the software made available to users based on the business, technical, or geographic requirements of the groups. The users can select from a list of published software through the Add/Remove Programs applet in the Control Panel. In addition, if a user opens a document that requires a published application, the required software will be installed automatically and the application will start.

Assigned software is installed automatically, without user choice or intervention. When new software is assigned to a computer, it is installed the next time that the computer is restarted. This type of configuration can be used to deploy service packs or driver updates to all computers on the network.

IIS FOR WEB SERVING

Microsoft's **Internet Information Service (IIS) 5.0** is included as part of Windows 2000 and used to provide Web services for clients on the network. Like many other Windows 2000 components, IIS is a feature-rich and detailed environment. Here we'll discuss the basic functions of IIS, installing IIS, and configuring folders for access over the World Wide Web.



In the previous versions, IIS was expanded as Internet Information Server. However, the version included with Windows 2000 is called Internet Information Services.

IIS has been included with Windows NT products, in one form or another, since version 3.51. The implementation included with Windows 2000 is much more robust than that provided in earlier versions of Windows NT and encompasses the complete set of components necessary to support a commercial Web site. Features of IIS include the following:

- *HTTP 1.1 support:* IIS supports version 1.1 of the HyperText Transfer Protocol (HTTP), which is used to transmit information on the Internet. HTTP 1.1 extends the capabilities of HTTP to include pipelining (which allows clients to send many requests before receiving a response from a server), persistent connections (which ensures that clients maintain connections with Internet servers by using keep-alives), and transfer chunk encoding for Active Server Pages.
- *Support for SMTP mail:* The Simple Mail Transfer Protocol (SMTP) was developed to facilitate sending specific types of e-mail messages, such as the confirmation messages generated by registering for a Web service.
- *NNTP support:* IIS includes support for the Network News Transfer Protocol (NNTP), which is used by applications to enable users to take part in local news discussion groups. Note, however, that the NNTP version included with Windows 2000 does not support full news feeds from the Internet. To obtain this functionality, you must purchase Microsoft Exchange Server.
- *Web application development tools:* IIS includes a number of tools and applications that can be used to design Web-based applications more effectively. They include support for transactional Active Server Pages, process isolation, message queuing, and an updated Java Virtual Machine.

IIS can be installed when the Windows 2000 operating system is installed by selecting the Internet Information Services box. If IIS was not installed at that time, it is easy to install all or some of the IIS components after the fact. IIS installation is detailed in Hands-on Project 11-5. The following components are available when installing the Windows 2000 version of IIS:

- *File Transfer Protocol (FTP) Server:* This component provides file transfer and management services for clients using the FTP protocol. FTP servers are often used in situations where clients need only to transfer files to their local systems, not view or change the files. An example of an FTP server would be an Internet site containing drivers for sound cards.

- *FrontPage 2000 Server Extensions*: Microsoft's Web page development application is FrontPage. The IIS installation provides special extensions that can be used on FrontPage 2000-generated Web pages.
- *Internet Information Services Snap-In*: This component is the MMC snap-in for the IIS services.
- *Internet Services Manager (HTML)*: In addition to the MMC, IIS can be managed through a Web interface if these components are installed. This feature allows for easy remote management of IIS servers regardless of their physical location.
- *NNTP Service*: As mentioned earlier, Windows 2000 IIS supports a localized NNTP news service if this application is installed.
- *SMTP Service*: This component supports SMTP mail messages such as those automatically generated by the IIS server.
- *Visual InterDev RAD Remote Deployment Support*: Visual InterDev is used to create interactive Web applications. The RAD Deployment Support module enables the remote deployment of InterDev applications on the Web server.
- *World Wide Web Server*: This component provides support for serving HTML documents to clients either on a local intranet or on the Internet.

Configuring Folders for IIS Access

Once IIS is installed, it must be configured to serve files in particular folders to Web clients. This configuration can be performed in one of two ways: through the **Internet Services Manager (ISM)**, or through the Properties dialog box for the folder. ISM is used to administer all IIS services and is accessed through the Administrative Tools group in the Start menu. It displays the information for the configured server and the services running on that server, as shown in Figure 11-15.

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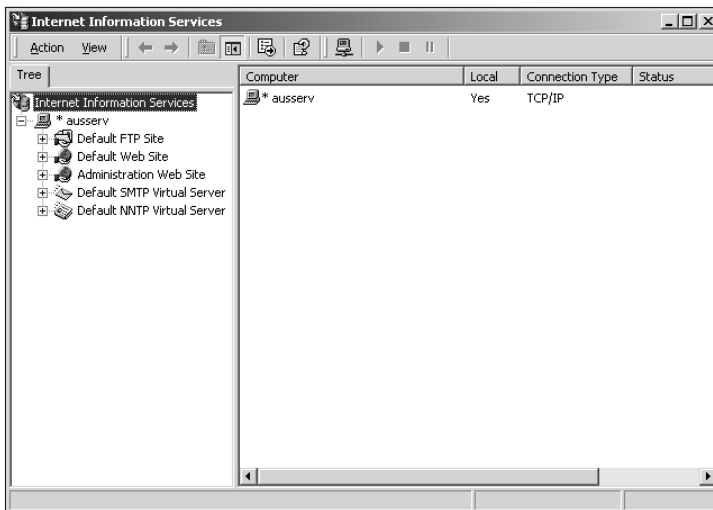


Figure 11-15 IIS running on a typical Web server

IIS can support multiple Web sites on a single server. In Figure 11-15, the Default Web Site is displayed along with the Default FTP Site, the Administration Web Site, the Default SMTP Virtual Server, and the Default NNTP Virtual Server. Folders that are served by the Web service are called **virtual directories**. To enable a folder to be accessed by the Web service, select New from the Action menu, then select Virtual Directory. The Virtual Directory Creation Wizard will then open.

When the initial screen of the dialog box appears, click Next. You are next prompted to provide an alias for the virtual directory. When selecting this alias, the same naming conventions used when naming another folder or directory apply. For example, if this folder provides Human Resources data to the company's intranet, you might name the alias HR Data. Click Next to proceed with the Virtual Directory creation.

Now you will be asked to specify the folder that will hold the shared content. Click Browse to locate the directory on the server, click OK, then click Next. Note that the content folder does not have to be shared before it provides data to the Web. Creating the virtual directory will share the folder and its contents to the Web service for distribution on the Web.

The next screen shown in Figure 11-16 asks you to specify the access permissions for the virtual directory. The options are Read, Run scripts (such as ASP), Execute (such as ISAPI applications or CGI), Write, and Browse. The default permissions, Read and Run, are sufficient for most Web sites. Execute should be enabled only if special applications or scripts are used on the Web site. Write should not be enabled for most Web sites, because it gives any user the ability to place files in the virtual directory. The Browse permission provides very limited access to the virtual directory and is not sufficient on its own to support a Web site. Click Next, then Finish to complete creation of the virtual directory. The files in the folder are now available for distribution by the Web service.



Figure 11-16 Available virtual directory permissions

Sharing Folders

As mentioned, you can also share a folder for Web access through the folder's Properties dialog box. To begin, use Windows Explorer to locate the folder that will be accessed from the Web. Right-click the folder name, and select Properties from the displayed menu. Click the Web Sharing tab, shown in Figure 11-17, to configure the folder for use by IIS. Select the Web site to which to share the folder from the Share on: drop-down list.



This method can be used only for existing Web sites. To share a folder to a new Web site, you must use ISM.

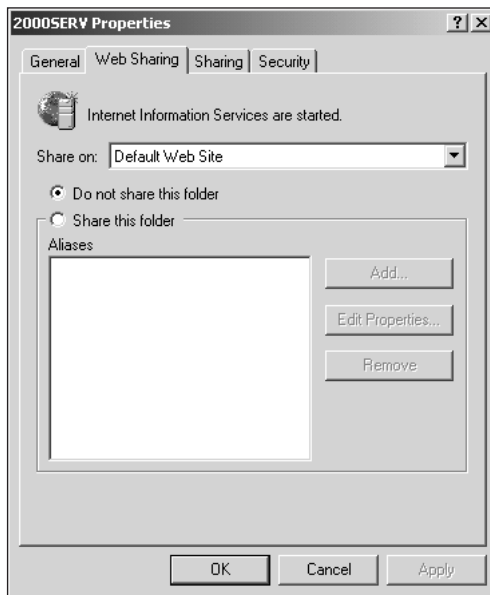


Figure 11-17 Web Sharing tab for the 2000SERV folder

Clicking the radio button next to Share this folder invokes the Edit Alias dialog box. Through this dialog box, you specify the name of the alias and the access permissions for the virtual directory. The access permissions displayed differ somewhat from those seen in the ISM. The Access permissions section of the dialog box lets you select or deselect Read, Write, Script source access, and Directory browsing. The Application permissions area lets you select whether no applications can be run (None), only scripts will be run (Scripts), or all applications can be run (Execute). By default, the Read and Scripts selections are used, which equate to the Read and Run permissions as configured through the ISM. Once these configurations are set, IIS will provide Web services for the files in the specified folders.

TERMINAL SERVICES

Windows 2000 **Terminal Services** provide Windows emulation to disparate hardware platforms in a heterogeneous network environment. Through terminal emulation, you can deploy 32-bit Windows “thin client” solutions to a full range of client computers on your network, regardless of their current Windows operating system. This ability provides a mainframe-like environment in which low-cost terminals can be spread throughout the network, but managed from a central location.

Windows 2000 Terminal Services consists of four components: the Terminal Server, the Remote Display Protocol, the Terminal Server Client, and the Administration Tools.

The Terminal Server is a multiuser server module capable of hosting multiple client sessions on a Windows 2000 Server. It can directly host multiple client desktop environments running on both Windows- and non-Windows-based hardware. If applications are properly written to support Terminal Services, multiple users should be able to utilize the applications simultaneously. In addition, the standard Windows 2000 management utilities can be used to manage the client desktops.

The **Remote Display Protocol (RDP)** has been developed to facilitate client communication with the Terminal Server on the network. It is based on the International Telecommunications Union’s T.120 standard protocol, which supports encryption and is tuned for high-bandwidth enterprise environments. The Terminal Server Client software presents the familiar Windows user interface on a wide variety of client computers.

The Terminal Server Client software can be loaded on personal computers running Windows for Workgroups 3.11, Windows 95/Windows 98, Windows NT 3.51 and 4.0, and Windows 2000 Professional. In addition, new terminal devices can be created that embed the Terminal Services Client software on the device to realize true “thin client” configurations.

The Terminal Services also offer set of Administration Tools that follow the standard Windows 2000 administration look and feel. These tools include the Terminal Services License Manager, the Terminal Server Client Creator, the Terminal Services Configuration Snap-In for the MMC, and Terminal Server Administration tools for managing client sessions. Additional Performance Monitor objects (Session and User) are available to provide monitoring and tuning for the unique Terminal Services environment.

Setting Up Terminal Services

Establishing a Terminal Services environment involves two steps: installing Terminal Services on the Windows 2000 Server, and installing the client software on the client computers on the network. Installing Terminal Services on a Windows 2000 Server is accomplished in the same way as you would install other Windows 2000 components. Terminal Services installation is detailed in Hands-on Project 11-4.

In most cases, you will want to license Terminal Services only to your domain or workgroup. Ensure that this option is selected and click Next; this action will begin installing the software from the Windows 2000 CD. Click Finish to complete the installation. Click Yes when

prompted to restart the computer. The Windows 2000 Terminal Services will then be installed on the server and ready to accept connections from clients.

The first step in connecting a client computer to the Terminal Server is to create the installation disks necessary for the client. This goal is accomplished by using the Terminal Services Client Creator application, located in Start/Programs/Administrative Tools. Selecting this program starts the Client Creator application, as shown in Figure 11-18. Three types of installation disks can be created: Terminal Services for 16-bit windows, Terminal Services for 32-bit x86 windows, and Terminal Services for 32-bit Alpha windows. You can also choose the floppy drive to which the files will be copied and whether to format the disks before creation.

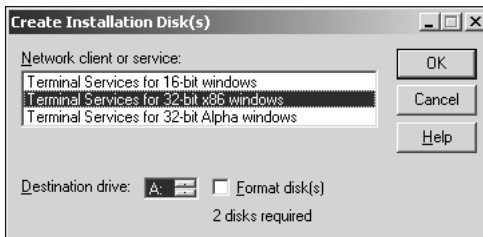


Figure 11-18 Terminal Services Client Creator application



The number of disks required depends on the client type being created. Terminal Services for 16-bit windows requires four disks, whereas both 32-bit versions require only two disks.

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After selecting the client type, click OK to continue. You are asked to insert the disk that will be Installation Disk 1 into the drive and click OK to continue. A final confirmation dialog box states that this process will erase all data on the disk. Click Yes to continue. When prompted, insert Disk 2, click OK, then confirm by clicking Yes.

Once the installation disks are created, you can install the Terminal Client software on the client computers. Regardless of the client type, this installation consists of loading Disk 1 into the floppy drive and running the `a:\setup` program. You will be prompted to supply a destination directory for the software. No additional configuration options are available for this software. Once the software is installed, you can connect to the Terminal Server by starting the Terminal Services Client software. On a Windows 95 computer, for example, you would select Start, Programs, Terminal Services Client, then click the Terminal Services Client application. When the application starts, you will be asked to specify the server to which you want to connect and the screen area to be used for the Terminal window. Select the server and click Connect. When prompted, log on to the server. After successfully logging in, you will be able to run any applications loaded on the server as if you were sitting at the server's console.

Administration Tools

When Terminal Services is installed on a Windows 2000 Server, two other administration tools are installed as well. The Administration Tool is used to manage Terminal Server

processes, sessions, and users connected to the Terminal Server. For example, it is used to send a message to a session or user, reset a session, display session connection information, disconnect a session or user, display client information, and manage Terminal Server processes. The Terminal Server Configuration tool is used to manage Terminal Server sessions and session sets. For example, it handles configuring a new connection, managing permissions for a connection, managing Terminal Server users and groups, and managing disconnect and timeout settings. Each of these tools is available in the Administrative Tools group of the Start menu.

CHAPTER SUMMARY

- The need to share resources is perhaps the single biggest reason for installing networks. Users are granted direct access to resources directly connected to their computers, but they must be specifically granted access to resources reached through the network.
- Windows 2000 computers display shared resources in the My Network Places dialog box, which is similar to Network Neighborhood on other Windows versions. When a client using the My Network Places dialog box double-clicks a specific resource, the user is granted access based on his or her permissions for that resource. If the user is not allowed to access a resource, an “Access denied” message appears.
- Windows 2000 printers are added through the Add Printer Wizard in the Printers applet of the Control Panel. Existing printers are shared via the Sharing tab of a printer’s properties. Additional drivers can be loaded on the print server to support other types of clients, such as Windows 95/98.
- With Windows 2000, Microsoft introduced IntelliMirror, which is a combination of utilities that provide advanced control over computers on the network. Three utilities make up IntelliMirror: User Data Management, Software Installation and Maintenance, and User Settings Management. Administrators can either publish or assign software in the IntelliMirror environment. Published software is made available to users on an as-needed basis depending on their business, technical, or geographic requirements. Assigned software is installed automatically, without user intervention, the next time that the computer restarts. Software assignment is used to ensure that all network users have the same version of software and is often applied to service packs and driver updates.
- Internet Information Services 5.0 provides Web services in Windows 2000. It supports HTTP 1.1, SMTP, NNTP, and advanced Web application development tools, such as Active Server Pages. The IIS installation is part of the Windows 2000 component installation.
- Windows 2000 also supports virtual terminal access through Terminal Services, which allows Windows-based clients to access applications loaded on the Terminal Server as if the user were sitting directly at the server console. This capability allows for thin client compatibility in a mainframe-like environment.

KEY TERMS

- assigned software** — Software that is installed automatically when a user reboots his or her computer. The feature is often used for software patches and service packs.
- Automatic Caching for Documents** — The caching option that automatically caches only those files that are accessed by the user. This setting does not cache the entire contents of the directory, nor does it require user intervention.
- Automatic Caching for Programs** — The caching option that automatically copies the entire contents of the folder to the user's local cache.
- broadcast** — The signal sent across the network by a resource to notify users of its availability.
- DFS link** — A pointer to an additional share included in the DFS configuration.
- DFS root** — The local server share that acts as the starting point for users to access resources on the DFS share.
- Internet Information Services (IIS)** — Microsoft's Web services software that is included with Windows 2000 and is used to make information available on the World Wide Web.
- Internet Services Manager (ISM)** — The application used to manage and maintain IIS applications.
- local print device** — A printing device directly connected to the computer.
- Manual Caching for Documents** — The caching setting that requires users to manually transfer files to be used offline from the server to their local computer; this is the default setting for shares.
- My Network Places** — The starting point for accessing network resources on a Windows 2000 computer.
- network-interface print device** — A printing device attached to a special network interface card that does not require a direct computer connection.
- Network Place** — A resource on the network, generally accessed through a shortcut from the My Network Places dialog box.
- Offline Files and Folders** — The Windows 2000 feature that allows users to cache files on their local drives for access when they are not connected to the network.
- print device** — A physical printing device.
- print driver** — A software component that is used to translate print jobs into the language used by the print device.
- printer** — A software interface between the operating system and the physical printing device.
- print server** — A computer configured to manage the printing activities of one or more print devices.
- published software** — Software made available to users on an as-needed basis. Users can select from the list of published software to determine whether they want to install available applications.
- Remote Display Protocol (RDP)** — The specialized protocol developed for Terminal Services that facilitates communication between the client and the server.

Terminal Services — The Windows 2000 component that provides access to the Windows 2000 console for many types of clients. Similar to terminal functions in a mainframe environment.

virtual directories — Folders used by the Web service to provide content to the Internet.

REVIEW QUESTIONS

1. Which of the following protocols is used by Terminal Services for communication between the client and the server?
 - a. FTP
 - b. NNTP
 - c. RDP
 - d. SMTP
2. If a user attempts to connect to a network resource to which he or she has not previously been granted access, the Windows 2000 security system will prompt the user to provide a valid user name and password for the resource. True or False?
3. In Windows 2000, _____ is similar to Network Neighborhood in Windows 95/98.
4. By default, a share's name is the same as the device's name. True or False?
5. Which of the following software types is automatically downloaded to a user's computer without the user's intervention?
 - a. Requested
 - b. Assigned
 - c. Mandated
 - d. Published
6. A(n) _____ is a software interface between the operating system and a physical print device.
7. The _____ caching method copies only those files that are opened by the user to the cache.
8. Which of the following access types can be granted or denied for a shared CD-ROM drive? (Choose all that apply.)
 - a. Modify
 - b. Read
 - c. Change
 - d. Full Control
9. The NNTP server included with Windows 2000 IIS does not support full news feeds from the Internet. True or False?

10. Which of the following must be installed to administer an IIS server from a Web interface?
 - a. Internet Services Manager (HTML)
 - b. Internet Information Services snap-in
 - c. World Wide Web server
 - d. FrontPage 2000 Server Extensions
11. Both file systems supported by Windows 2000 provide the same level of security. True or False?
12. The Windows 2000 _____ feature allows files to be accessed by a mobile user even when the user is not connected to the network.
13. Which of the following is displayed when the Computers Near Me dialog box is opened?
 - a. All computers on the network
 - b. Only computers with the same IP address
 - c. All computers to which a certain user is logged on
 - d. Only computers in the same domain or workgroup
14. By default, _____ users are allowed to connect to a newly created share.
15. Virtual directories can be established only through the Internet Services Manager. True or False?
16. To easily connect to frequently accessed shared network resources, use the _____ to create a _____.
17. Which of the following DFS root types uses Active Directory to store the DFS configuration?
 - a. Active root
 - b. Domain root
 - c. Standalone root
 - d. Primary root
18. To print in a Windows 2000 environment, it is not necessary for a computer to act as a print server. True or False?
19. Which of the following can be used to configure a shared folder for use by IIS? (Choose all that apply.)
 - a. The ISM
 - b. The System applet in Control Panel
 - c. The Properties dialog box for the folder
 - d. The Server applet in Control Panel
20. The Terminal Services client software is designed to operate on all versions of Windows since version 3.11. True or False?

HANDS-ON PROJECTS



Project 11-1

To add a network shortcut in the My Network Places dialog box:

1. Log on to a Windows 2000 computer.
2. Double-click **My Network Places** on the desktop.
3. Double-click **Add Network Place** to open the Add Network Place Wizard.
4. To locate the folder to which you would like to create the shortcut, click **Browse**. A diagram of the network will appear, like that shown in Figure 11-19.

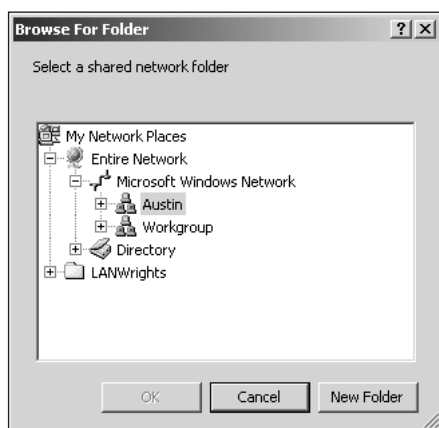


Figure 11-19 Browse For Folder dialog box

5. Navigate through the network to locate the shared folder to which you want to connect, highlight it, and then click **OK**.
6. Click **Next** to proceed with the Add Network Place Wizard.
7. Provide a descriptive name for the shortcut you're creating, and then click **Finish** to complete the process. The folder to which you connected will open to ensure that you have connected to the correct location. Close the window and review the My Network Places dialog box. It should now include the newly created shortcut.



Project 11-2

To share a device or folder:

1. If you are not currently logged on, log on to a Windows 2000 computer.
2. Double-click **My Computer** and select the **CD-ROM** drive in your system. If your system does not include a CD-ROM drive, double-click a hard drive and select a folder.
3. Right-click the selected device, and then choose **Sharing** from the menu.
4. The Properties dialog box for the device will open to the Sharing tab.

5. Select **Share this folder** (refer to Figure 11-4).
6. Enter a name for the shared device. Remember that the share name should be readily understood by others on the network and should describe the location and function of the resource.
7. Add a comment to further describe the shared device.
8. Specify that only five users will be allowed to access the device simultaneously by clicking the radio button next to **Allow** and using the scroll buttons to change the value to **5** (refer to Figure 11-6).
9. Click **OK** to complete sharing the device. After the device is shared, a hand appears on the icon for the device. It indicates that the device is shared and can be accessed from the network.



Project 11-3



You will not need a physical printer device attached to the system to complete this project.

To create printer on a Windows 2000 computer:

1. If you are not already logged on to a Windows 2000 computer, do so as an **Administrator**.
2. Open the Printers dialog box by selecting **Start, Settings, Printers**.
3. Double-click the **Add Printer** icon.
4. On the first screen of the Add Printer Wizard dialog box, click **Next**.
5. For this exercise, you will be connecting a local printer. Ensure that the **Local printer** option is selected (refer to Figure 11-11).
6. Uncheck the box next to **Automatically detect and install my Plug and Play printer**, if necessary. Because you may not have a printer connected to your machine, you do not want to take this step.
7. Click **Next**.
8. Select the port to which the printer is connected. For the purpose of this exercise, select **LPT1** (unless this port is already assigned to a printer, otherwise select LPT2) in the **Use the following port area** of the dialog box (see Figure 11-20).
9. Click **Next**.
10. From the list of available printers, select **Epson** from the left window.
11. Scroll through the list of printers in the right window, and select **Epson Stylus COLOR 740 ESC/P 2**.
12. Click **Next**.
13. Enter a descriptive name for the printer. Ensure that it accurately describes the type of printer and its location.

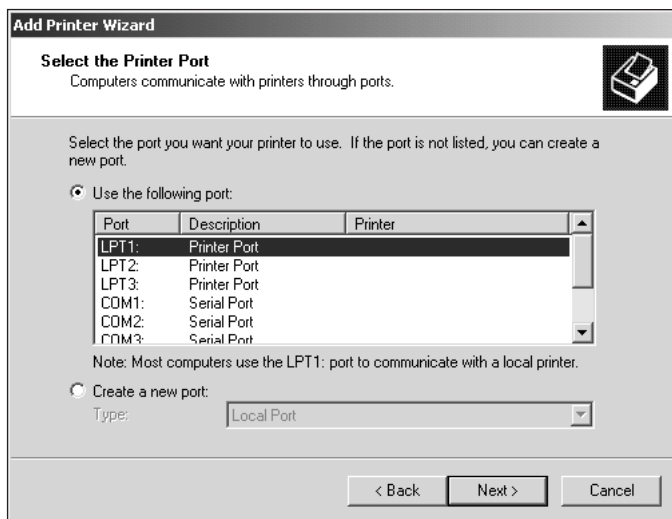


Figure 11-20 Selecting a port for the printer

14. Select the **Yes** radio button to ensure that Windows-based programs will use the new printer as the default (see Figure 11-21).

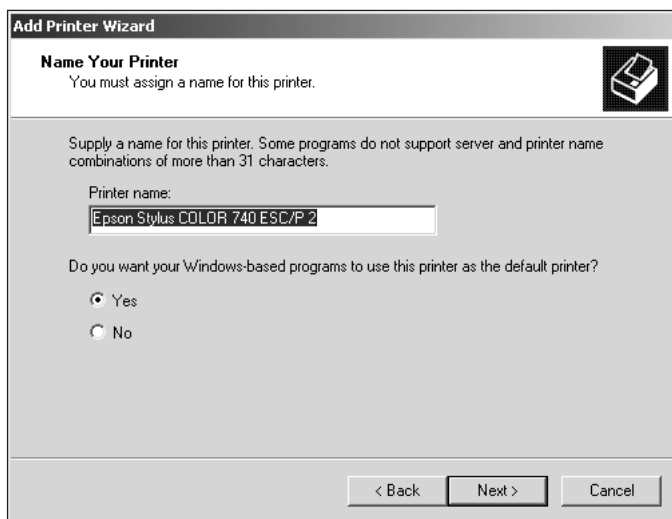


Figure 11-21 Naming the new printer and setting it as the default

15. Click **Next**.
16. Ensure that the radio button next to **Do not share this printer** is selected, and click **Next**.
17. Select **No** when asked if you want to print a test page.

18. Click **Next**.
19. Figure 11-22 shows the final dialog box of the Add New Printer Wizard as it should appear on your screen. Click **Finish** to complete the installation.

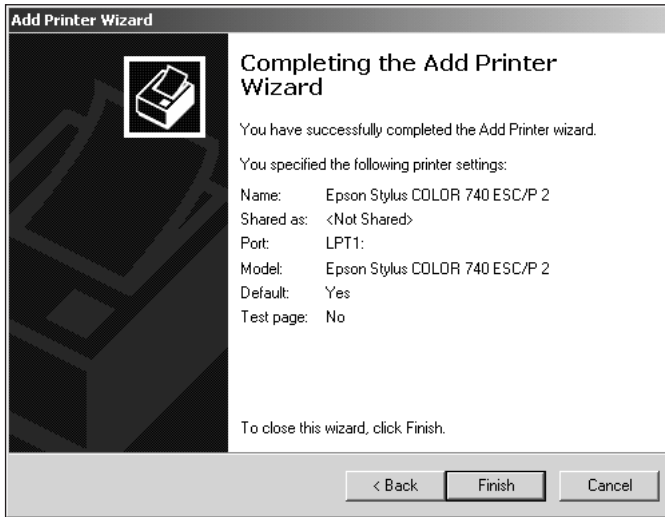


Figure 11-22 Final dialog box of the Add New Printer Wizard



Project 11-4

To install Terminal Services:

1. Open the Control Panel (**Start, Settings, Control Panel**).
2. Double-click **Add/Remove Programs**.
3. Select **Add/Remove Windows Components**, select the **Terminal Services** and **Terminal Services Licensing** check boxes (see Figure 11-23) from the list of available components, and then click **Next**.

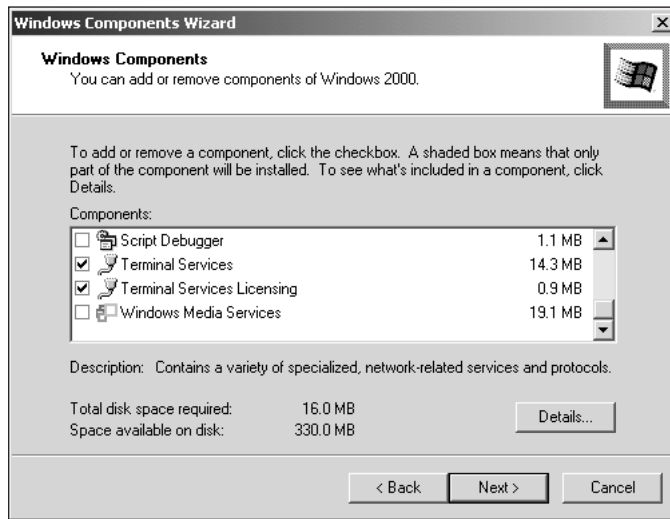


Figure 11-23 Adding Terminal Services and Terminal Services Licensing

4. You will be asked whether this server will operate in Remote administration mode or Application server mode. Select **Remote administration mode**, (see Figure 11-24) and click **Next**.

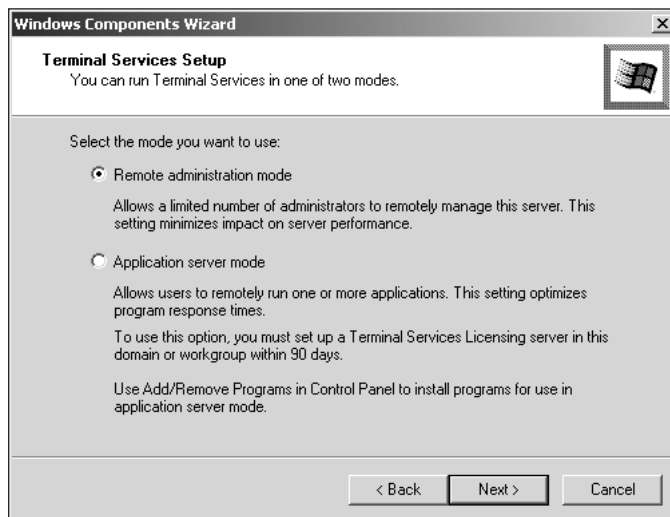


Figure 11-24 Selecting Remote administration mode

5. Specify to whom Terminal Services will be licensed—either the entire enterprise or just your domain or workgroup.
6. Click **Next**, then click Finish, and then click **Yes** to reboot the computer.



Project 11-5

To install IIS:

1. Launch the **Control Panel** and select **Add/Remove Programs**.
2. Click the **Add/Remove Windows Components** button. A list of all Windows 2000 components will be displayed, with those that are currently installed indicated by check marks.
3. You can check the check box next to the Internet Information Services (IIS) option to load all IIS components. To select only certain components, click the **Details** button.
4. Once you have selected the desired components, click **OK** to return to the Windows Components Wizard dialog box, shown in Figure 11-25.

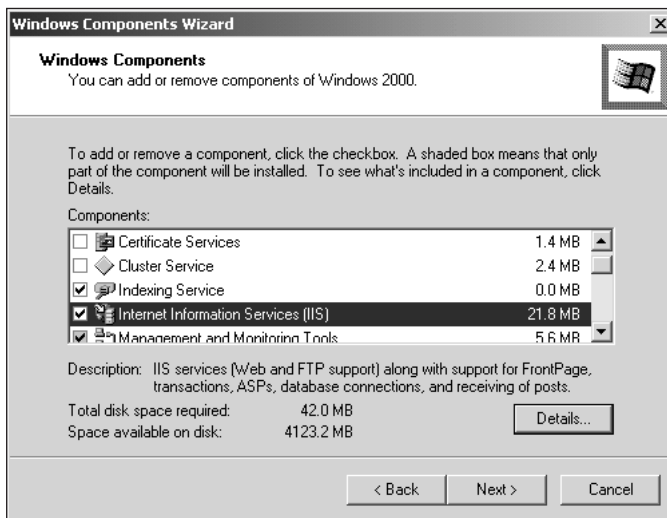


Figure 11-25 Windows Component Wizard

5. Click **Next** to continue installing the IIS components selected.
6. In the next dialog box, select **Remote Administration mode** or **Application server**. Click **Next** to copy the files from the Windows 2000 CD-ROM. Once the installation is complete, IIS is ready for operation.

CASE PROJECTS

1. As the administrator for an enterprise network, you have been struggling with training issues with regard to users understanding the layout of the network and where their data and applications reside. While attending a conference in Las Vegas, you learned that Windows 2000 supports DFS and you feel that it will help you reduce users' confusion. Your network encompasses more than 300 servers, but 16 servers are reserved for the Engineering department, its applications, and its data. Develop a test plan for implementing a Windows 2000 Server and DFS for use in the Engineering department. Include information on the DFS roots and DFS links, their configuration, and their maintenance.
2. You have begun implementing an intranet for information specific to your company. You realize that the default folders available in IIS are not sufficient to support the various Web sites needed. Develop a plan for adding virtual directories to the current Web site to include human resources, information technology, and marketing information. Each department has its own server on the network from which the information should be read.
3. In trying to convince your boss to upgrade to Windows 2000, you noted the increased application support provided by the new operating system. Your initial plan was to upgrade all client computers on your network to support Windows 2000 Professional. Budgets being what they are, your boss approved only the purchase of the new server and its applications. Your network consists of 130 Windows for Workgroups systems and 55 Windows 95 systems that you were planning to upgrade. Develop an implementation plan for providing all client computers with access to the applications that are available on the Windows 2000 Server.
4. At inception, your small company was able to allocate dedicated printers to all employees. However, you have experienced phenomenal growth in the last year, increasing from 23 employees to more than 100. It has become evident that the old way of doing things will no longer work. Your company is divided into six divisions, each of which requires shared printing access. You have 20 printers to share among the various departments in the company. Develop a plan to share the printers effectively and outline the steps required to implement the plan.